

AMENDMENTS TO THE DRAWINGS:

The attached sheets of drawings include changes to Figures 1, 2, 4, and 5. These sheets, which include Figures 1, 2, 4, and 5, replace the original sheet including Figures 1, 2, 4, and 5.

In Figure 1, a legend is added indicating "Prior Art".

In Figures 2, 4, and 5, the reference character in the upper right for the multi-stage compressor is amended from "30" to "40".

Attachment: Replacement Sheets

REMARKS

The application has been amended and is believed to be in condition for allowance.

Amendments to the Disclosure

Figure 1 is amended to include the legend "Prior Art" to overcome the Official Action's objection.

Figures 2, 4 and 5 are amended to address a typographical issue, wherein the reference character in the upper right for the multi-stage compressor is amended from "30" to "40" consistent with page 4, lines 34-37 of the specification as originally filed.

The specification is amended to include section headings.

Claims 1 and 7 are amended to clarify the recited features of the invention. The amendments find support in the specification and the drawing figures as originally filed (e.g., page 5, lines 11-34; Figure 3).

Claims 1-13 are further amended to improve readability and to address antecedent basis issues and formal issues in consideration of U.S. practice and preferences.

The foregoing amendments to the claims do not introduce new matter.

Formal Matters - Objections to the Drawings

The Official Action objected to the drawing figures, stating that Figure 1 should include a legend such as "Prior Art" because only that which is old is illustrated.

In response, Figure 1 is amended to include a legend "Prior Art". Withdrawal of the objection to the drawings is thereby respectfully solicited.

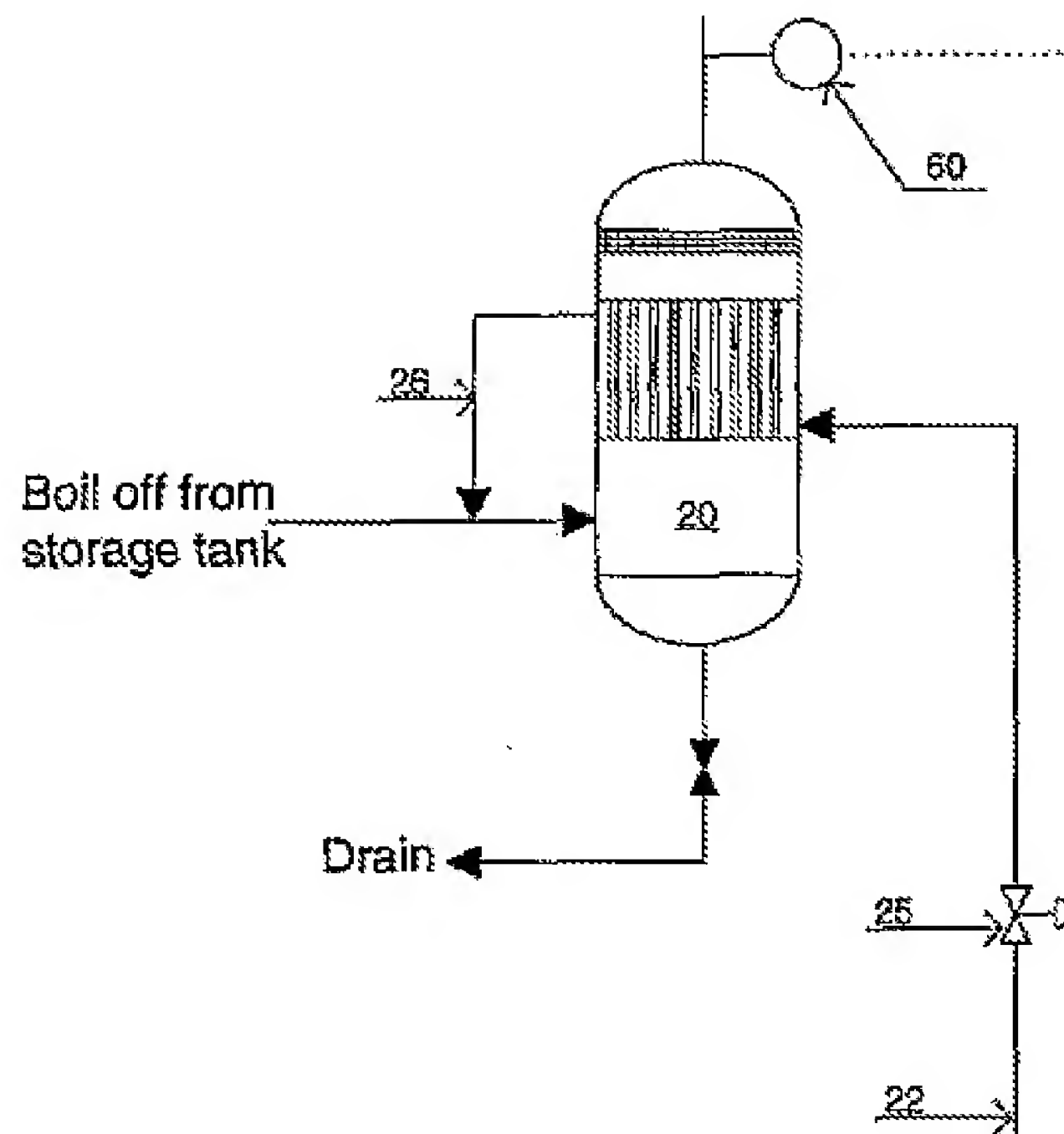
Formal Matters - Section 112, second paragraph

The Official Action rejected claims 2 and 8 under 35 USC 112, second paragraph as being indefinite.

As to claim 2, the Official Action alleges that it is unclear how mixing of evaporated LNG with boil-off gas occurs upstream of the heat exchange.

As to claim 8, the Official Action alleges that it is unclear how the combined mist separator and head exchanger can be connected to the feed line upstream from itself.

In reply, claims 2 and 8 are amended as indicated above to clarify the recited features. It is further respectfully submitted that a mixing of fully evaporated LNG with boil-off gas upstream of the heat exchange, as recited by claims 2 and 8, is adequately disclosed by the specification and the drawing figures as originally filed such that one of skill can readily comprehend the make the invention.



For example, Figure 2 (detailed above for the Examiner's convenience) discloses a "second conduit 26 fluidly connects the heat exchanger 20 to the boil-off gas feed line at a point upstream of the heat exchanger 20," (page 5, lines 14-15), wherein the heat exchanger is connected at its other side to the line carrying LNG from the cold box 30 to the storage tank (page 5, line 1 and lines 11-14). The arrowed line extending from the legend "Boil off from storage tank" clearly indicates the boil-off gas feed line with a direction toward the combined mist separator and heat exchanger 20. The second conduit 26 meets the boil-off gas feed line at a point prior to the intersection with the combined mist separator and heat exchanger 20.

Hence, LNG fully evaporated by the combined mist separator and heat exchanger 20 mixes with the boil-off gas at a

location upstream of said boil-off gas entering the combined mist separator and heat exchanger 20.

Accordingly it is respectfully submitted that the recitations of claims 2 and 8 are not indefinite.

Withdrawal of the rejections under 35 USC 112, second paragraph is respectfully solicited.

Substantive Issues - Section 102

The Official Action rejected claims 1, 2, 5-8 and 11-13 under 35 USC 102(e) as being anticipated by Irie et al. (US Pub. 2004/0068993; "IRIE").

In response, it is firstly noted that independent claims 1 and 7 are amended to clarify the recited features of the invention. It is respectfully submitted that IRIE fails to teach either a heat exchanging step as recited in amended claim 1 or a combined mist separator and heat exchanger as recited by amended claim 7.

The Official Action states that IRIE discloses a mist separator 2 (Figure 1) that will inherently exchange heat between the boil-off gas and the vaporizing LNG that are mixed within. However, this is not what is claimed in amended claims 1 and 7.

Claim 1 requires heat exchanging the boil-off gas with a condensed liquefied gas (LNG) through a wall separating said boil-off gas from said condensed liquefied gas (LNG).

Similarly, claim 7 requires a cooler in said combined mist separator and heat exchanger comprising a wall configured to

separate the boil-off gas from said condensed boil-off gas (LNG) and configured to transfer heat between the boil-off gas and said condensed boil-off gas (LNG).

As indicated by the Official Action, IRIE fails to teach this, but instead teaches heat exchange by mixing the boil-off gas with condensed LNG in the mist separator 2. Hence, IRIE fails to teach a heat exchange wherein a wall separates the hot fluid from the cold fluid.

On the contrary, IRIE describes a method of pre-cooling the boil off gas by injecting LNG (condensed boil off gas) into the commonly used mist separator. The process IRIE describes is a mixing process where vapor and liquid are mixed. However, an issue with the concept described by IRIE is that the efficiency of spraying is uncertain and where less volatile components in the liquid may not vaporize entirely and collects as warmer liquids in the bottom of the mist separator. This is more prone to happen on the described ballast voyage than the laden voyage. A second issue with spraying into the mist separator is that the probability of liquid carry-over into the compressor increases.

In contrast, the heat transfer method as described in claim 1 allows the independent fluids to be treated differently after the heat exchange has taken place. For example, claims 8, 9, 10 allow for various mixing points after heat exchanging.

With a combined heat exchanger and mist separator as described in the present invention as claimed, the heat transfer

process is controlled in a more secure manner drastically reducing the probability of non vaporized component and lower risk of liquid carry over, and further provides for a more sophisticated system of control.

Accordingly, it is respectfully submitted that IRIE fails to anticipate independent claims 1 and 7, and accordingly, claims 1 and 7, and claims depending therefrom, are patentable.

Substantive Issues - Section 103

The Official Action rejected claims 3 and 9 under 35 USC 103(a) as being unpatentable over IRIE in view of Nelson et al. (US 5,036,671; "NELSON"). The Official Action concedes that IRIE fails to disclose mixing fluids between compression stages. The Official Action contends that NELSON teaches illustrates stream 82 which combines boil-off gas with liquefied gas between compression stages 64 and 89, and the it would have been obvious to have modified the boil-off gas cooler of IRIE to combine the boil-off gas the liquefied gas between the compression stages to provide cooled fluid entering the higher compression stage to keep the compressor cool.

The Official Action rejected claims 4 and 10 under 35 USC 103(a) as being unpatentable over IRIE in view of Pozivil (US Pub. 2001/0042377; "POZIVIL"). The Official Action concedes that IRIE fails to disclose mixing fluids after the compression stages. The Official Action contends that POZIVIL teaches mixer 46 combining compressed boil-off gas with liquefied gas following

final compression stage 30, and that it would have been obvious to have modified the boil-off gas cooler of IRIE to combine the boil-off gas the liquefied gas after the compression stages to cool the fluid that will re-enter the storage tank.

In response, it is firstly respectfully submitted that dependent claims 3, 4, 9 and 10 are believed to patentable at least for depending from a patentable parent claim.

Further as to claims 3 and 9, it is respectfully submitted that NELSON teaches two streams 82 and 89, both of approximate equal temperature (ambient) that are mixed and further recompressed and either used as fuel or recycled (see column 6 line 22 to column 7 line 3). Hence, there is no cooling effect as proposed by the Official Action. Therefore, the process and function is different from the claimed invention, and one of skill would have had no reasonable motivation to have combined the teachings as proposed by the Official Action.

Accordingly, claims 3 and 9 are respectfully submitted as patentable in their own right in addition to being dependent from a patentable parent claim.

Further as to claims 4 and 10, it is respectfully submitted that POZIVIL describes a method where LNG is sprayed into mixing chamber 44 primarily in order to reduce the molecular fraction of nitrogen in the boil off gas stream, and secondly to ensure stable temperature in to the condenser 50 (see paragraph [0032]).

However, POZIVIL fails to teach that the output from the mixing chamber 44 returns directly to the tank. Instead, the mixed medium from mixing chamber 44 flows to another condenser 50 which further cools the LNG (paragraph [0035]), and even this further cooled LNG from condenser 50 is usually not completely liquefied (paragraph [0036]).

Moreover, the LNG introduced into the mix at mixing chamber 44 is provided from the LNG tank itself (paragraph [0032]). One of skill would not reasonably seek to include a liquid pump in the LNG tank to extract more liquid from the tank in order to cool the boil-off vapor of the same tank, owing at least to the cost and heat unnecessarily introduced into the system by performing this function, which cannot provide any appreciable cooling, certainly not for the purpose of being reintroduced to the tank as in IRIE.

Again, the purpose of POZIVIL's mixing chamber 44 is to reduce the molecular fraction of nitrogen in the boil off gas stream, and to regulate a temperature for further condensation. IRIE is not concerned with these problems, and the introduction of this additional hardware and process would introduce additional cost, complication, and inefficiency such to render IRIE unsatisfactory for its intended purpose.

Accordingly, claims 4 and 10 are respectfully submitted as patentable in their own right in addition to being dependent from a patentable parent claim.

It is therefore respectfully submitted that one of skill would have had not rational motivation to combine IRIE with POZIVIL as proposed by the Official Action.

Reconsideration and allowance of the claims are respectfully requested.

From the foregoing, it will be apparent that Applicant has fully responded to the May 19, 2009 Official Action and that the claims as presented are patentable. In view of this, Applicant respectfully requests reconsideration of the claims, as presented, and their early passage to issue.

In order to expedite the prosecution of this case, the Examiner is invited to telephone the attorney for Applicant at the number set forth below if the Examiner is of the opinion that further discussion of this case would be helpful in advancing prosecution.

The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

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APPENDIX:

The Appendix includes the following items:

- ☒ - Replacement Sheets for Figures 1, 2, 4, and 5 of the drawings